OMIC R&D - Y5 Request for Proposals - Q & A

RFP #	TITLE	SUPPORTIVE INDUSTRY	TB Member	Q & A
A1	A1**: Spray coating of medium Carbon steel pre-forms to produce economical, sustainable milling cutting tools. [COATING: WC/CoCr 86/10-4, and WC/Ni 90/10]	*SECO*	***Brian Hoefler***	**Q1) Is the cold spray the only option that OMIC interested in or other options such as thermal spray, HVOF, HVAF can be proposed?** **Urmaze:** Cold spray should definitely be included. The primary intent/vision for the idea was an economical solution to traditional endmill mfg. Simply put, we are spraying a tool material onto a base metal (which is cheaper & readily available) with the hopes of getting carbide tool like performance. Therefore, if you as a Subject Matter Expert, feel that these other techniques will help us get there, we want to hear about it. So in my opinion, Yes, these are viable options to consider. **Q2) Can other materials beside WC-Co-Cr and WC-Ni be proposed?** **Urmaze:** Yes, why not. As above, the main intent is the eventual cutter performance. If we can make informed choices on adding to the list, then please do so. It will affect the project cost, so please be mindful not to make the list very large. If we can showcase the Proof-of-Concept with positive trends, then we can expand the list at a later stage. **Q3) All of the test are required to be carried out? Can the scope of the work be adjusted?** **Urmaze:** The test identified in the Abstract are standard tests that cutter manufacturers use to test coating adhesion. We want to make sure that the coating and substrate makes a suitable bond prior to testing. The eventual cutting test is perhaps the most important. If you adjust the scope of work, that is reasonable recommendation for you to make as an SME. I would make 3 recommendations for all projects, and globally on the above points: 1) We want to hear these recommendations of adjustments from SMEs. The Industry will greatly appreciate this. 2) In your Proposal, highlight these recommendations as "Adjustments to SOW". 3) Offer some reasoning for these recommendations, and how it will make for a better research project. **OVERALL FEEDBACK:** **David Maunu (Mitsubishi)**: Would just like to have an opportunity to pariticipat at the metal cutting portion of testing or evaluation at the end.
		MITSUBISHI	***David Maunu***	
		BLOUNT	***Nathan Davis***	
		SUMITOMO	***Pat Donahue***	

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RFP #	TITLE	SUPPORTIVE INDUSTRY	TB Member	Q & A
A6	A6****: Industry Evaluation of: CBN, Binderless Cubic Boron Nitride (CBN), Single Crystaline Diamond (SCD), Diamond Like Coatings (DLC), Polycrystaline Diamond (PCD)	*BOEING*	***Jeff Morgan***	**Q)** A) **OVERALL FEEDBACK:** **David Maunu (Mitsubishi):** Would just like to have an opportunity to pariticipat at the metal cutting portion of testing or evaluation at the end.
		MITSUBISHI	***David Maunu***	
		SECO	***Brian Hoefler***	
		SUMITOMO	***Pat Donahue***	

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RFP #	TITLE	SUPPORTIVE INDUSTRY	TB Member	Q & A
AM1	AM1**: Integrating sensors into additive manufacturing processes.	*SANDVIK*	***Dale Johnson, Dan Tucker***	**Q1) What specific 3-d printing technology are we looking for?** A) **Josh**: would say industry at this time is more interested in 3d for metal printing, wire arc manufactured components, DMLS, plastics probably not as much, ceramics. **Q2) Do you want to use laser or metal powder?** A) **Josh**: pick a 3d printing that you think would be most relevant to industry. Mention where it would be relevant in industry. **Urmaze**: We are not looking for someone's production solution, but rather a proof of concept, so that sensors can be embedded. i.e. pressure, temperature, strain gauges, and other sensory information, possibly even gyroscopes **Q3) There are some sensors that can be used to monitor the process, like cameras, are those sensors being included in the scope of this project or not?** A) Josh: more around embedded sensors and not sensors related to manufacturing process. **Q4) In the meeting last week, you mentioned that the scope of this project is looking at sensors "embedded" within the product structure being printed by the AM. I am currently testing a similar approach but the sensors are embedded within the substrate plate. During the printing process, the products are either directly built on the plate or via some support structures. So some of the mechanical properties of the printed part, such as residual stress and temperature gradient formed during cooling/crystallization, can be detected from the embedded sensors. I want to check if this approach is considered within the scope of this project or we are looking forward a sensor exactly in the printed structure. Do you have any comment?** A) **Tim Beyer:** The "product" could also be a production tool such as an injection molding die with complex conformal cooling channels. 3D printing allows the printing of complex shapes that are not possible with traditional subtractive manufacturing methods and if we want sensors and wiring embedded, they might not be able to be added after printing except by traditional manufacturing methods such as straight-line boring and this could jeopardize the structure of the complex 3D printed product. Looking to add sensors and circuits during the printing process by pausing and adding as well as printing the circuits directly into the objects as part of the print but with different materials. A) **Urmaze**: In terms of embedding the sensor, the key here is 'the ability to do so on the output solution'. This would help facilitate sensor locations that would typically be considered unreachable by traditional mounting means ***(see Tim Beyer's note above).*** The key take away in this project is to show proof-of-concept in the ability to embed a sensor during the 3D printing process.
		BLOUNT	***Nathan Davis***	
		MITSUBISHI	***David Maunu***	
		DAIMLER	***Tim Beyer***	
		BOEING	***Jeff Morgan***	
		SILVER EAGLE	***Jeff Passmore***	

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RFP #	TITLE	SUPPORTIVE INDUSTRY	TB Member	Q & A
AM3	AM3**: Development of cost efficient support structures while printing & their removal.	*ATI*	***Arnel Fajardo***	**Q1) Is it about the design and shape?** A) **JOSH:** Creating cost effective structures with ease of removal is at the forefront of this thought: 1) Optimize material usage to reduce the cost of support structures. 2) Optimize path motion to reduce printing time (similar to optimization related to CNC milling high speed cornering techniques) A) **Tim Beyer:** One of the opportunities would be about developing design guidelines or rules of thumb so that designers could predict requirements for support structures based on design and shape of the part. A big advantage would be to reduce the amount of trial run prints when the support structures fail and ruin parts. If that happens, parts have to be reprinted leading to: increase print time, material usage & scrap. I am currently involved with a 3D printing test project were we have tried dozens of print attempts without success because the support structures fail to support the part during sintering and collapse. Or they cause the part to warp. Our designers have no experience or rules of thumb for support structures to start with and it has just been a costly trial and error process. **Q2) In the materials you mention, they are mostly powder bed and not injector style?** A) **Josh:** Those (DMLS, SLS, etc) are the listed types, and assumed to have the most structure. However, if you have alternative ideas for industry relevance, we would be interested in hearing about them in the Proposal. **Overall comment, if you as SME's are aware of a pain-point, please express that as part of the proposal.**
		BLOUNT	***Nathan Davis***	
		MITSUBISHI	***David Maunu***	
		SANDVIK	***Dale Johnson, Dan Tucker***	
		DAIMLER	***Tim Beyer***	
		SUGINO	***Mickey Nakagawa, Teru Tsuji***	

OMIC R&D - Y5 Request for Proposals - Q & A

RFP #	TITLE	SUPPORTIVE INDUSTRY	TB Member	Q & A
AM5	AM5**: Improve surface finish on 3D printed parts	*BOEING*	***Jeff Morgan***	**Q1) At end of first para, mentions roughness of …. Goal to optimize and reduce. Is it saying that we are trying to minimize the roughness, for instance Ra20 or are we looking for a smaller value?** A) **Urmaze & Josh:** we recommend identifying the starting condition of a printer type (control), and the research shows us how much we improved it. Focus on the before & after type approch, with relative analysis. Most will accept a 63 Ra or lower (aerospace relevance, Jeff Morgan). **Q2) Interested in 5axis 3D printed…is that too far out for this abstract?** A) **Josh**: definitely love the idea of multi-axis printing. If 5-axis gets you there, definitely. **Q3) Asking for process optimization, written in the description as laser power, etc. Is this the goal of this project?** A) **Josh**: The RFP was written to help improve surface finish, and adjustment of parameters was a listed option for accomplishing this task. However, parameter optimization may not be the most prudent way to achieve desired surface finish, especially amongst conversations of multi-axis printing and non-planer slicing. What is most important with this project is to look at the value (improved surface finish) and construct a response based on what you believe the solution would be. We believe most companies would utilize this knowledge to reduce or eliminate post machining or finishing processes.
		SECO	***Brian Hoefler***	
		SUGINO	***Mickey Nakagawa, Teru Tsuji***	

OMIC R&D - Y5 Request for Proposals - Q & A

RFP #	TITLE	SUPPORTIVE INDUSTRY	TB Member	Q & A
M3	M3**: Exploring Mill-Turn machine strategy to replace traditional Tombstone setup.	*BOEING*	***Jeff Morgan***	**Q1) NONE** A)
		SECO	***Brian Hoefler***	
		HEIDENHAIN	***Gisbert Ledvon***	
		WFL	***Marcel Bollinger***	

OMIC R&D - Y5 Request for Proposals - Q & A

RFP #	TITLE	SUPPORTIVE INDUSTRY	TB Member	Q & A
M12	M12***: Evaluate machining of 3D printed parts as compared to traditional stock material.	*SECO*	***Brian Hoefler***	**Q1) Look at the wear and the tolerances of the part and the tool, look at the dynamics of the process, is that reasonable regarding the scope?** A) **Urmaze**: Yes. Additionally, 3D Printing is fundamentally getting us to near net shape. If 3d printing was mainstream tomorrow, what does the state of machining it look like post printing. The traditional process employs roughing, seminifinish, and finishing. However, the 3D printed future state would employ semifinish and finish. If so, what gains are to be enjoyed, and how would the technology have to evolve (Speed, feed, cutters, machines, spindles, controllers). **Q2) So we are looking at the finishing not the roughing process? And a little bit of toolwear, speed, & finish. We have to find the problem as compared to commercial finishing?** A) **Urmaze**: See above response. Josh: 3d prints will have layers, and we know you will see depth of cut notching…how does continuous cutting affect the cutting tool, how do we alter the tool to minimize these wear effects…(that's just one example). **Q3) For AM, the quality of the metal depends on the process, powder bed fusion, for the same kind of materials, type of raw materials, machinability of the part or sample could be very different. Any type of 3d parts that are going to be used in this project?** A) **Josh**: none were specifically identified. Would suggest picking an industry relevant example, and recommend the Proposal value added toward that industry. **OVERALL FEEDBACK:** **Gisbert Ledvon (HEIDENHAIN):** This is how I look at this: 1. Scope: Post processing/HSC of a 3D printed part to a desire finish and accuracy. 2. Machine this part via the conventional approach; selecting a specific tool path and conventional milling approach with step down approach and pre calculated speeds and feeds. Record cutting time, surface finish tool wear and accuracy. 3. Repeat the test by applying trochoidial machining (if possible) utilizing adaptive spindle/feed control on the AXILE machine. Record cutting time, surface finish tool wear and accuracy. 4. Compare to part machined out of solid (non 3D printed) block of material applying 2 & 3 testing process. **Brian Hoefler (SECO):** I agree and add that some assessment of aesthetics and functionality of the finished components be made. **David Maunu (Mitsubishi):** Would just like to have an opportunity to pariticipat at the metal cutting portion of testing or evaluation at the end.
		MITSUBISHI	***David Maunu***	
		SUMITOMO	***Pat Donahue***	
		SANDVIK	***Dale Johnson, Dan Tucker***	
		DAIMLER	***Tim Beyer***	
		BOEING	***Jeff Morgan***	
		SUGINO	***Mickey Nakagawa, Teru Tsuji***	
		HEIDENHAIN	***Gisbert Ledvon***	

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RFP #	TITLE	SUPPORTIVE INDUSTRY	TB Member	Q & A
R1	R1***: Implementation Robot haptic (sense of touch) feedback for study of texture analysis and gripping.	*BOEING*	***Jeff Morgan***	**Q1) Have solved similar problems, any balance on haptic sensors other than robustness, or types of sensors that most interested in?** A) **Josh**: would limit it to what would be commercially available within reasonable cost. Allows some freedom and creativity. Jordan: pitched as a "imagine having your grippers in your process" **Q2) Part textures or geometries of interest? Is there anything under the project description details to focus on?** A) **Urmaze**: This is a young field to us, will check with industry here also. look to you (as SME) for your feedback on incremental staging of such a research. The value of this is going to be the incorporation of sensors before getting into anything too complex. **Overall note, please always think high level solution oriented rather than for one specific company.** **Q3) What types of materials trying to pick up with end effector or the temperature range, and the texture.** A) **Urmaze**: yes, it is a wide scope the way it reads now. We want to start with fundamentals that are most value to industry. Josh: Could be an assembly type operation, a pick and place operation. Would suggest that when you identify your project plan, identify the use case and relevance to industry. **OVERALL FEEDBACK** **Jeff Morgan:** for this project I picture them picking up an egg and placing it in an egg carton. If they are able to use off the shelf sensors and show the ability to perform delicate operations quickly it would have a wide range of opportunities. Maybe this would provide the guidance needed. If more or different train of thought is needed please let me know. **Tom Szambelan (Cobot Team)**: We look forward to supporting this project and research. We have knowledge of some commercially available grippers that might be helpful in these efforts (Q1). We also feel that the force sending within the Sawyer collaborative arm itself, could also help with the force sensing, feel, and data available and could possibly help with Q2. Brendan and Justin on our team can provide some additional information and insights. There are a lot of possibilities, and we look forward to supporting the task of picking up and egg and placing in an egg carton as well. We have a gripper we would like to try. https://youtu.be/xd558_3FvA8
		COBOT	***Tom Szambelan***	

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RFP #	TITLE	SUPPORTIVE INDUSTRY	TB Member	Q & A
R2	R2**: Robotic controlled 3D printer for enhanced capability	*SILVER EAGLE*	***Jeff Passmore***	**Q1) Is this basically a large artifact? and Printer should be mobile and ? It sounds like we don't want to be able to rotate the object?** A) **Urmaze & Josh:** Yes to all. Silver Eagle was highly motivated by this project also. The project can show proof of concept by way of smaller parts that are more manageable in test environment. You have the option to partner with Industry. Yes the printer should be mobile and flexible toward a factory floor environment. Yes, rotating the part in a production environment could be a challenge, so we would prefer not having to do so. **Q2) What kind of 3d printing are they looking for here?** A) **Urmaze & Josh:** Non-environmental controlled processes (Wire additive, HVOF, Cold Spray, etc), but would open up to anything that is more of a mobile process. Would emphasize general proof of concept here. The project can later evolve into a Specific Project that addresses a specific production need of a industry member. **Q3) Are you looking for some sort of robotic demonstration?** A) **Urmaze & Josh:** Not necessarily on one of a specific industry products, but yes a practical demonstration with a facsimile part would be appreciated. Not everything that gets printed will be in a z-axis plane. **Q4) Should we include the procurement of the materials in the proposal?** A) **YES** **Q5) Dimension of the geometry? What print dimensions are you looking for?** A) **Urmaze & Josh:** Focus on scalable Proof of Concept rather than any specific part. Will seek more input from industry.
		SANDVIK	***Greg Pope, Dale Johnson, Dan Tucker.***	

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RFP #	TITLE	SUPPORTIVE INDUSTRY	TB Member	Q & A
R7	R7*: Robotic vision system for quantitative & qualitative inspection (including composites, oily reflective parts)	*BOEING*	***Jeff Morgan***	**Q1) What tolerance are you looking to measure to?** A) **Urmaze**: We will seek additional input from industry. However, general focus on the proof of concept of such a capability. **Jeff Morgan:** if this system is to be used for inspection purposes that means it can take up no more than 10% of the total tolerance. Since machining tolerances are feature specific it is hard to say, but in general most tolerances are between 0.010" to 0.030". If this is the case then the vision system could take up no more an 0.001" – 0.003" of the tolerance band. This is my recommendation for a proof of concept.
		BLOUNT	***Nathan Davis***	
		ATI	***Arnel Fajardo***	